

# Beyond the Born Approximation: Resolving the Proton Form Factor Problem with Positron-Proton Scattering

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## **Abstract.**

Results from experiments at Jefferson Laboratory, Newport News VA, which measured the ratio of the electric to magnetic form factors of the proton,  $G_E/G_M$ , have forced us to reexamine the single photon exchange approximation in lepton-proton elastic scattering. Discrepancies between the ratio obtained via the time-tested Rosenbluth separation method and newer polarization transfer measurements, which differ by as much as a factor of three at  $Q^2 \approx 6 \text{ GeV}^2$ , may be resolved by considering the effect of two photon exchange (TPE) processes. A large experimental effort is being undertaken at several laboratories around the world, including DESY (Hamburg, Germany), BINP (Novosibirsk, Russia) and Jefferson Laboratory. These experiments will determine the effect of two-photon exchange in elastic lepton-proton scattering by precisely measuring the ratio of positron-proton to electron-proton elastic cross sections (R). At Jefferson Laboratory, we have measured R over a wide kinematic range ( $0.1 < \epsilon < 0.96$ ,  $0.2 \leq Q^2 \leq 2.0 \text{ GeV}^2$ ), using a simultaneous nearly identical beam of electrons and positrons in Hall B at Jefferson Lab. This talk will describe the experimental techniques used to produce this beam, the analysis techniques to identify elastic scattering events, and preliminary results.

**Keywords:** proton, form factors, two photon exchange